

High Speed Rail: Phase 2b Preferred Route

Sustainability Statement including Post Consultation Update

Appendix C10 – Waste

A report by Temple-RSK for HS2 Ltd



TEMPLE

LEADERS IN ENVIRONMENT,
PLANNING & SUSTAINABILITY.

RSK

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1. INTRODUCTION

- 1.1.1. This report has been prepared to support the HS2 Phase 2b Sustainability Statement including Post Consultation Update report, which describes the extent to which the Government's preferred route for HS2 Phase 2b supports objectives for sustainable development. This document is a technical appendix which summarises the methodology for appraising waste, and the key findings and conclusions that inform the Sustainability Statement main report. The Sustainability Statement places emphasis on the known key impacts only at this stage in the design, prior to commencing the Environmental Impact Assessment.
- 1.1.2. The eastern and western legs of the preferred route pass close to¹ or intersect over 50 closed and operational (active) landfill sites. Landfill sites may contain both hazardous and non-hazardous waste. The sites recorded in the data used date back to the beginning of the twentieth century and standards of landfill have changed markedly over the intervening years, as such some landfill sites may contain unreacted hazardous chemicals and asbestos.
- 1.1.3. Many of the sites will contain biodegradable materials producing flammable gas (methane) and polluting liquid leached from the waste mass (leachate). The extent of any risks likely to be presented by these, and where these are manifested, will depend not only on the waste materials but also on their age, the engineering of the site and the surrounding geology.

2. SCOPE AND METHOD

2.1. Scope

- 2.1.1. This report sets out the hazards to the environment as a result of the proximity of the preferred route to landfills, and presents a ranking of landfill sites according to the potential hazard they may pose. The assessment reports those landfill sites identified in the Environment Agency dataset², where:
- the landfill site boundary lies within 250m either side of the centre line of the preferred route³; and
 - the nature of the construction and the intersection with, or proximity to, the landfill site was considered potentially to present an environment threat.
- 2.1.2. The potential effects of the route on these landfill sites and the resultant potential risks to the environment were considered firstly in relation to groundwater, and then in relation to the location of sensitive environments: Ramsar sites, Special Areas of Conservation, Special Protection Areas, Sites of Special Scientific Interest (SSSIs), Registered Parks and Gardens, and rivers. Potential risks to the preferred route corridor have also been considered, in respect of the impact these landfill sites may have on the route itself.

¹ Close to is defined as within 250 metres of a landfill site boundary.

² Environment Agency digital datasets: HIS_ENVAG_Historic_Landfill_Sites_010k and LAU_ENVAG_Authorised_Landfill_Sites_010k

³ The centre line of the preferred route is the mid-point of the track as shown on the engineering plan and profile drawings.

2.2. Methodology

- 2.2.1. The appraisal was carried out in two stages; firstly, to identify a long list of all landfills close to the preferred route and secondly, to identify a short list of higher risk landfills for further hazard assessment. For the first stage, a 250m boundary was drawn on each side of the centre line to identify a long list of landfills which may be impacted by the route. These sites were also appraised for the potential effects that they might have on the preferred route in relation to the available data, taking into account superficial and bedrock geology, and principal and superficial aquifers.
- 2.2.2. The second appraisal stage used the profile of the preferred route at the intersection with, or at the point closest to, each landfill site together with the information about the geology and groundwater from the first appraisal stage to determine where the preferred route was potentially most likely to create an adverse environmental impact arising from the disturbance of landfill. These were:
- landfills intersected by the route in a cutting, tunnel, at grade, embankment or viaduct; and
 - landfills not intersected by the route but where the landfill was within 25m of the centre line in tunnel or cutting.
- 2.2.3. A hazard scoring system was devised to quantify the landfill hazard based on characteristics of the landfill and the proximity of the preferred route to the landfill sites. This second stage appraisal was carried out to produce an overall hazard rating (by multiplying individual hazard scores). Where an overall hazard rating of 100 or more was identified, consideration was given as to whether there were any protected features (designated sites such as Special Area of Conservation, Sites of Special Scientific Interest, Local Nature Reserves etc noted in the tables as 'Other targets') within 2.5km so that these can be taken into account, as appropriate, as the scheme is further developed.
- 2.2.4. The landfill hazard, intersect parameters and scoring system used in the second stage of appraisal are set out in **Table 2-1**.

Table 2-1 – Landfill hazard and intersect parameters and scoring system

Waste hazard	Score	Size (area in Ha)	Score	Intersect type	Score	Length of intersect	Score
Inert/cut and fill (e.g. surplus material from earthworks)	1	<1	1	No intersect but within 25m of a cut/tunnel	1	No intersect	1
Construction & Demolition waste	2	<5	2	At Grade	2	<25m	2
Non-hazardous (old sites)	4	<25	3	Embankment	2.5	25-100m	3
Non-hazardous (new sites)	7	25-50	4	Viaduct	3.5	101-500m	4
Hazardous/Industrial in-house	10	>50	5	Cutting or tunnel	5	>500m	5

Explanatory table note

The potential threat to the environment resulting from the intersection or proximity of the preferred route to existing landfill sites was considered, in relation to the data available, to be a function of the following: the type/age of waste; the area of the landfill; the type of intersect between the preferred route and the landfill site; and the length of the landfill site that would be intersected by the preferred route. For each landfill in the second stage appraisal, a score was assigned for each parameter in **Table 2-1**. These scores were multiplied together to produce an overall hazard rating, with hazardous landfills attracting a higher score.

Thus, an inert landfill site of less than five hectares in area, where there was no intersect would score $1 \times 2 \times 1 \times 1 = 2$; whereas a hazardous landfill site with an area of 30 hectares and a 250m intersect in a tunnel would have an overall hazard rating of $10 \times 4 \times 5 \times 4 = 800$.

2.3. Key assumptions and limitations

- 2.3.1. Inevitably given the strategic nature of the AoS process, the appraisal is relatively high level and should not be confused with a full and detailed environmental impact assessment. The level of detail of the appraisal is commensurate with the data available and the strategic nature of the preferred route.
- 2.3.2. The hazard rating reflects the relative hazard posed by the sites appraised, based on the landfill data for the likely type and age of waste, size of the landfill and the nature of the route intersection. The hazard rating does not take into account any physical barriers, for example the presence or absence of engineering measures (capping and lining of landfill) or geological strata to ameliorate any potential pollution, although the latter are commented on where relevant, as is the proximity to any intersect and sensitivity of the targets.
- 2.3.3. The rating relates only to potential direct environmental impacts upon the preferred route. It does not cover health and safety risks during construction works to on-site workers or to nearby populations, with the exception of potential landfill gas migration. Therefore, the overall hazard ratings should be seen as a relative indication only. The factors that might affect a more detailed risk assessment were not available and therefore could not be taken into account.
- 2.3.4. At this stage of scheme development, it was considered that the preferred scheme would not impact on any landfill whose boundary was further than 250m from the centre line of the route. More detailed analysis at the next stage of design (in the form of an Environmental Impact Assessment (EIA)) will inform a more detailed understanding of impacts on hazardous landfills. The next phase of detailed design will also consider any revisions to the environmental data available. To enable a consistent comparison of route options, the data sets used in the AoS have to be frozen at the start of each design stage. For the last design stage, the base data was frozen in January 2014 following consultation. It is recognised that the Environment Agency provide regular updates to their data sets and as such some sites may have been designated (or amended) since this date.
- 2.3.5. It is important to note the following limitations in the data:
- Former landfill sites form the majority of the sites analysed and these datasets were collected in separate exercises from almost 50 waste disposal/regulation authorities in England (operating in and around 1990) and, assembled from an even earlier set of data (collected around 1970) by British Geological Survey for government. Consequently, there is a risk of inconsistency in terms of available information;
 - The GIS landfill shapefile⁴ is interpreted as the boundary of the fill material. However, each shapefile shows the licensed or permitted boundary and is likely to be more extensive than the boundary of the fill;
 - No appraisal has been made of any impact on global air quality (for example due to potential contributions to greenhouse gases);
 - Where applicable, only a general appraisal of the threat to the public due to dusts, spores and asbestos is possible related to the nature and size of the intersection;
 - Proximity to rivers is taken into account but the direction of flow and therefore the consequential downstream effects are not considered; and

⁴ Environment Agency 'Authorised Landfill Sites and Historic Landfill Sites' dataset

- Waste input information is notoriously inaccurate; sites authorised for hazardous waste may not have received any hazardous waste and, conversely, for example, sites classified as inert may have received large quantities of biodegradable waste. Therefore there may be a large variation in the reported content of the landfill and what is ultimately found on site.

3. FINDINGS AND HAZARD RATINGS

3.1.1. This section summarises the findings of the landfill hazard assessment undertaken for the preferred route. The results of the hazard assessment are presented in **Annex A (Tables A1-A4)**. Details of all the landfill sites considered, including those not subject to the hazard assessment in **Annex A**, are presented in **Annex B (Tables B1-B4)**. These are split into operational and non-operational sites for both the western and eastern legs.

3.2. Western leg

- 3.2.1. The appraisal identified two active (operational) landfill sites and seven disused (non-operational) landfill sites within 250m on the western leg of the preferred route. Higher risks were identified for both of the active sites and three of the disused sites, based on the type and length of crossing, the size of the landfill and its recorded contents.
- 3.2.2. The active sites are both permitted for hazardous/industrial waste. The Bostock landfill north-east of Winsford would be crossed on embankment and viaduct for about 395m, although associated environmental impacts are unlikely as the site is deep underground. The Risley IV landfill south of Culcheth would be crossed at grade and on embankment for about 140m, although the crossing would impact the surface water run-off ponds and not the landfill cells. Risley landfill has now ceased accepting domestic waste and is in the process of undergoing site restoration and landscaping.
- 3.2.3. Of the seven disused landfills identified, three are designated for non-hazardous waste (Hollins Green tip east of Warrington, Lowton Sidings east of Golborne, and Former British Railways tip at Tommy's Lane).

3.3. Eastern leg

- 3.3.1. The appraisal identified seven active (operational) landfill sites and 46 disused (non-operational) landfill sites within 250m on the eastern leg of the preferred route. Higher risks were identified for four of the active sites and 15 of the disused sites, based on the type and length of crossing, the size of the landfill and its recorded contents.
- 3.3.2. The four active landfills identified as higher risk comprise:
- Kingsbury Landfill west of Wood End and designated for inert and non-hazardous waste would be crossed by embankment for approximately 190m;
 - Measham landfill (an active mineral/brick working area) south of Measham and designated for industrial waste would be crossed by viaduct for approximately 550m;
 - Mexborough Landfill to the east of Mexborough and designated for household, commercial and industrial waste would be crossed predominantly in cutting for approximately 220m; and
 - Welbeck Landfill east of Wakefield and designated for hazardous/industrial

waste, would be crossed by embankment for approximately 25m.

- 3.3.3. Of the 15 disused landfills identified, five are designated for hazardous/industrial waste (Measham Red Bank Brickworks at Measham, Cragg Lane at Blackwell, Railway Cutting at Wales, Brickworks Quarry at Mexborough, and Smoile Wood west of Newbold).

3.4. Summary

- 3.4.1. Overall, while a large number of sites were identified in this review, the number of high risk landfill sites is relatively low. Moreover, while construction around these sites could present a risk to local streams and receptors, measures would be developed and applied to control any such effects (i.e. through typical or standard environmental protection measures). This would need to be considered further as part of the development of the scheme design.
- 3.4.2. The majority of the sites are either operational and/or contain biodegradable waste and, therefore, potentially liable to the production of landfill gas and/or leachate. Any works that impact these sites could compromise gas/leachate collection systems resulting in the uncontrolled release of landfill gas containing methane and potentially subsurface migration to nearby buildings. As part of further development of the scheme design, this potential should be assessed on a site by site basis. Appropriate mitigation and management measures would be identified, where required.
- 3.4.3. Excavation at any of these landfill sites would create dust that potentially could impact on nearby populations in the absence of mitigation/ management. Appropriate mitigation/management measures would be developed and applied.

Figure 3-1 - Western leg preferred route historic and authorised landfill sites

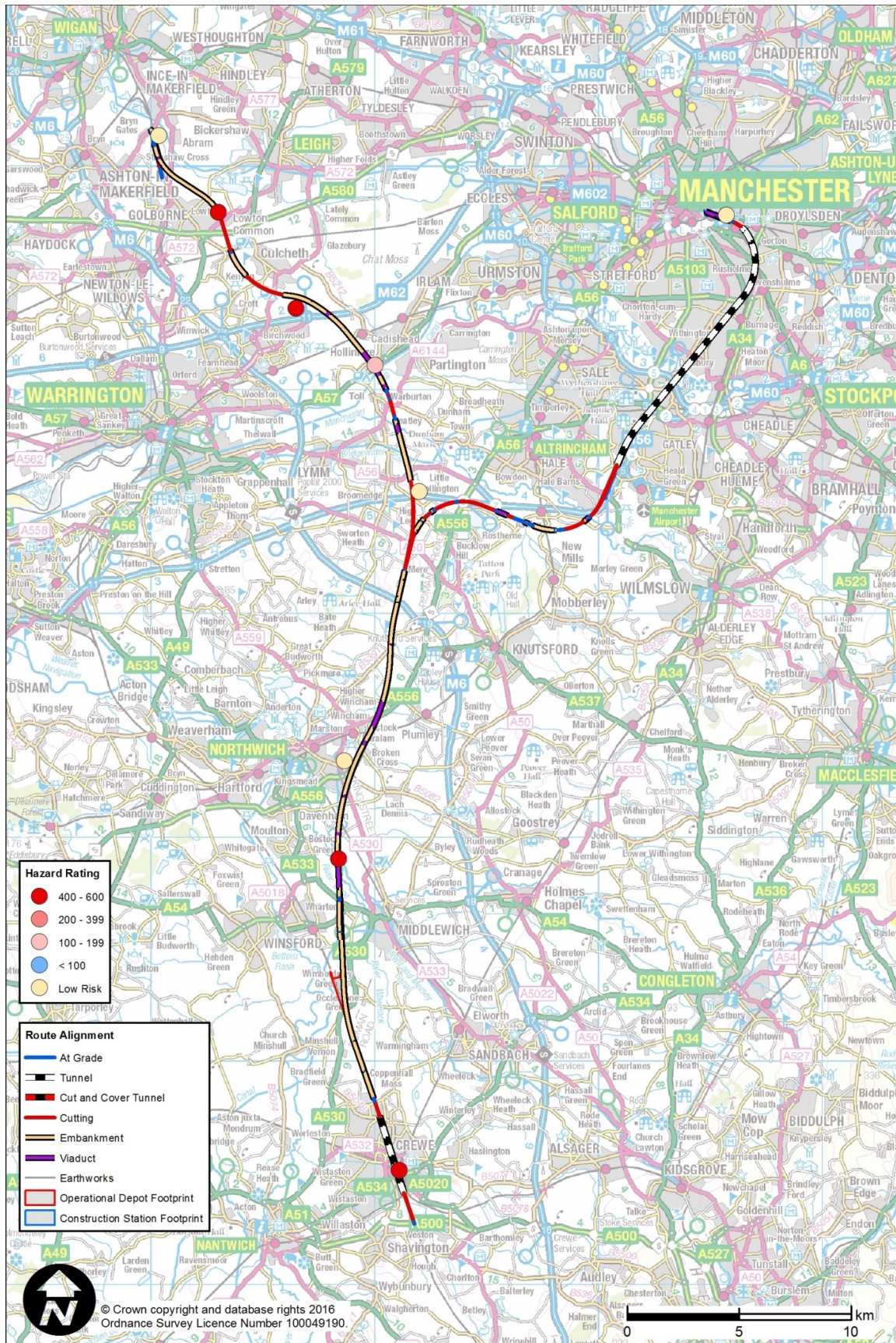


Figure 3-2a - Eastern leg preferred route historic and authorised landfill sites

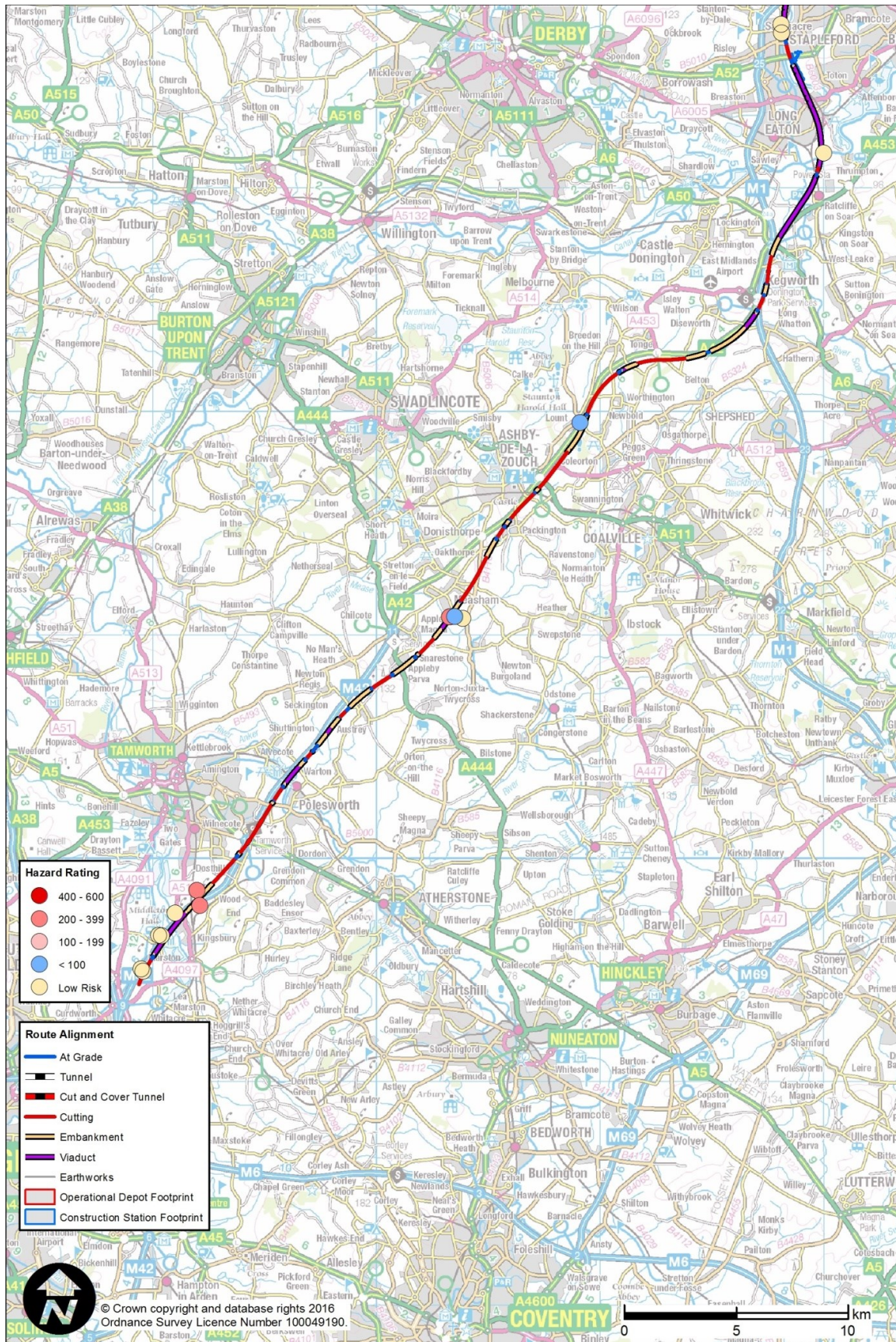


Figure 3-2b - Eastern leg preferred route historic and authorised landfill sites

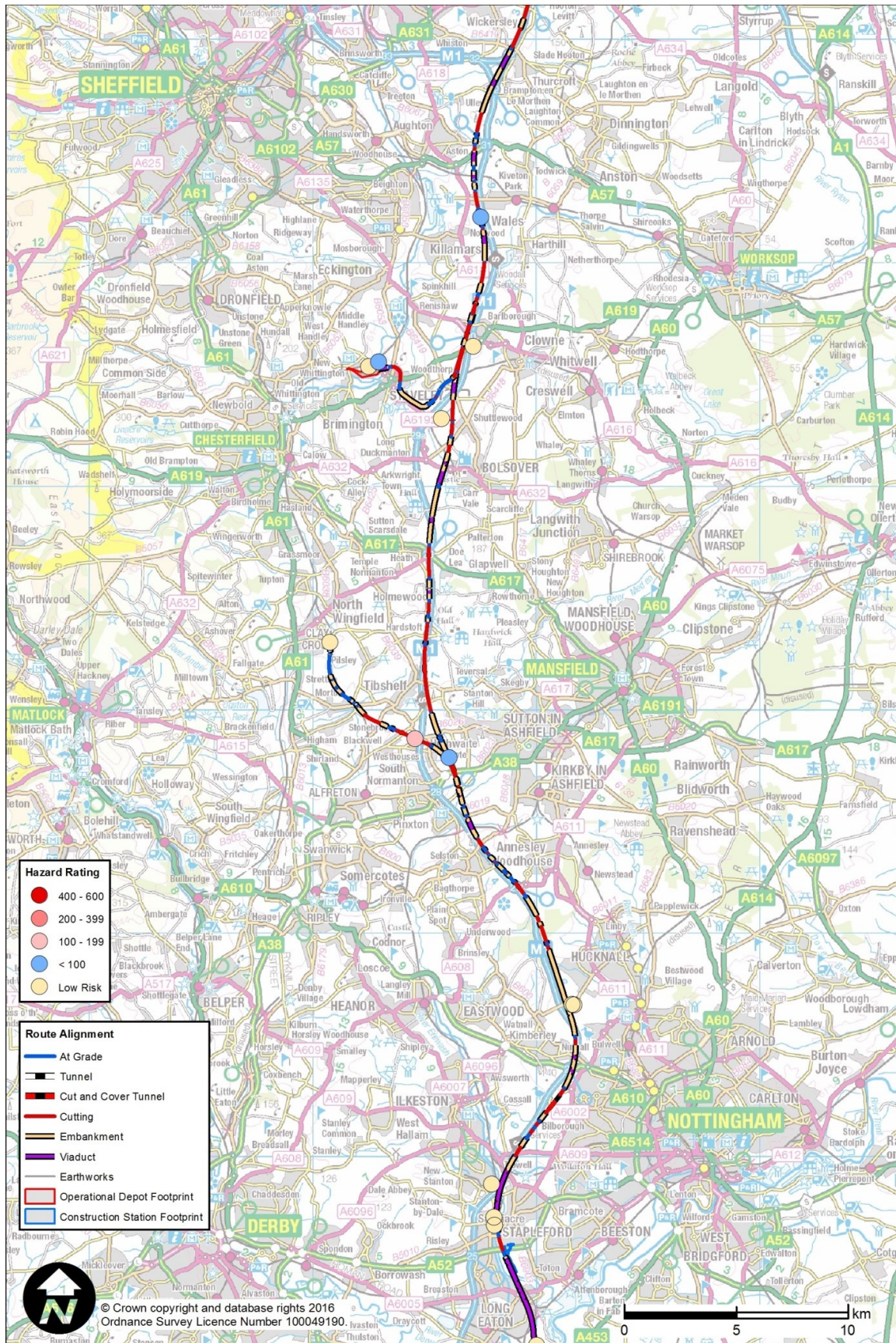
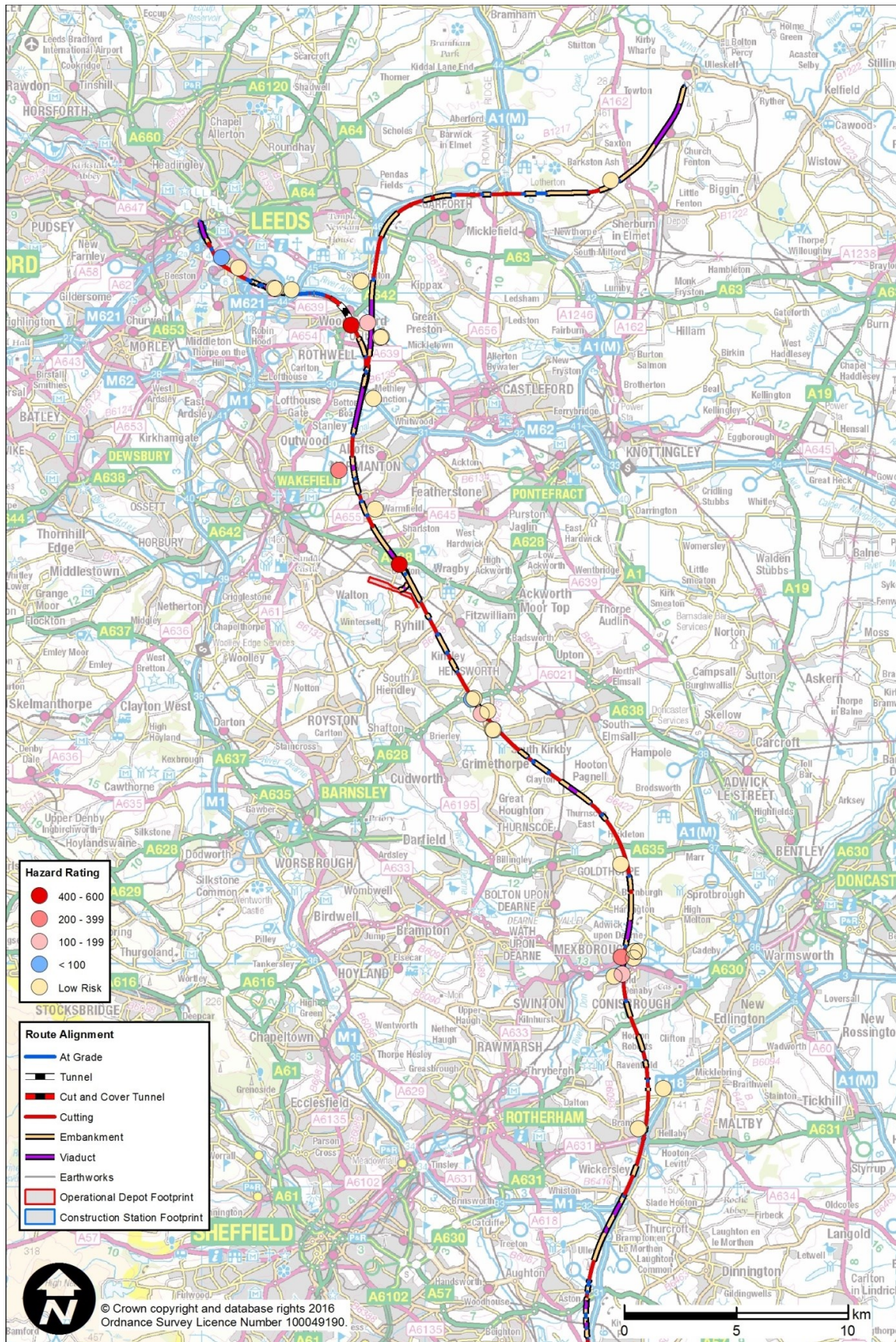


Figure 3-2c - Eastern leg preferred route historic and authorised landfill sites



ANNEXES – HAZARD ASSESSMENT

Glossary

AG	At Grade
CM	Coal Measures
Comm	Commercial waste
Cut	Cutting
Dist	Distance of preferred route from landfill site boundary
Emb	Embankment
HHold	Household waste
ID	Polygon shapefile identification number
Ind	Industrial waste
Inert	Inert waste
Length	Length of any intersect
LNR	Local Nature Reserve
Mds	Mudstone
N/K	Not known
N/R	Not recorded
NR	No superficial or bedrock information recorded on EA/BGS website
SAC	Special Area of Conservation
Sist	Siltstone
SSSI	Site of Special Scientific Interest
Sst	Sandstone

	Where no waste information is known or both hazardous and non-hazardous waste is accepted, worst case waste rating has been applied
	Worst case intersect type applied

NB: Characterisation of landfill site as 'old' or 'new' has been made based on first input date before or after the publication of Landfill Directive 2002.

The named geology, especially the superficial geology, represents the surface geology and other types of superficial geology may be present at depth.

Where multiple intersects impact the landfill, a combination of the length of all intersects has been used.

Stated thickness of bedrock based on published information from the British Geological Survey.

ANNEX A Preferred Scheme Hazard Rating

Table A1 - Hazard Rating: Western Leg – Operational Landfill Sites

Site Name	ID	Intersect	Length	Dist (m)	Route surface type	Superficial Aquifer	Bedrock Aquifer	Superficial Geology	Bedrock Geology	Other targets	Waste	Size	I/S type	Length	Score
Minosus Ltd	496	Yes ⁵	395	0	Viaduct (70m)/Embankment (325m)	Unproductive	Secondary A/Secondary (undifferentiated)	Diamicton, river terrace deposits (sand and gravel), alluvium (clay, silt, sand and gravel)	Halite stone and mudstone (Northwich Halite Member)	Drain immediately to northwest and continues to southwest. Weaver Navigation located 1km southwest	10	4	3.5	4	560
Risley IV Landfill Site	857	Yes	173	0	Embankment	Secondary (undifferentiated)	Principal	Diamicton	Sandstone (Wilmslow Sandstone Formation)	Proximity to groundwater source protection zone 3. SSSIs: Holcroft Moss 1.5km east, Risley Moss 1.1km south, Manchester Moss SAC 1.3km east, Risley Moss LNR 1.06km south, Glaze Brook 1.6km northeast	10	5	2.5	4	500

Table A2 - Hazard Rating: Eastern Leg – Operational Landfill Sites

Site Name	ID	Intersect	Length	Dist (m)	Route surface type	Superficial Aquifer	Bedrock Aquifer	Superficial Geology	Bedrock Geology	Other targets	Waste	Size	I/S type	Length	Score
Kingsbury - Inert & Non Hazardous Waste Landfill Site	215	Yes	191	0	Embankment	NR	Secondary A	NR	Etruria Formation - Mds, Sst and Halesowen Formation - Sst and Pennine Lower CM - Mds, Sils, Sst	Clay pit onsite and works/clay pit immediately north, several ponds onsite and stream 20m east, Kingsbury wood SSSI 810m southeast, Cliffs Wood LNR 960m west	7	4	2.5	4	280
Red Bank Manufacturing Measham Landfill Site	599	Yes	549	0	Viaduct	NR/Secondary A	Secondary undifferentiated	NR/River Terrace Deposits/ Alluvium	Tarporley Siltstone Formation (upto 220m thick), Bromsgrove Sandstone Formation (15-40m thick)	Within Total Catchment (zone 3), onsite clay pit and pond, River Mease located immediately west. River Mease also a SSSI and SAC	4	4	3.5	5	280
Mexborough Landfill	209	Yes	44 (Emb), 10 (AG), 156 (cut)	0	Embankment, At Grade, Cutting	NR	Secondary A	NR	Pennine Middle CM - Mds, Sils, Sst	River Dearne 640m north, River Don 150m south, Old Denby Wetlands LNR 200m south, Denby Ings SSSI 650m northeast	4	3	5	4	240
Welbeck Landfill Site	892	Yes	26	0	Embankment	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Mds, Sils, Sst	River Calder adjacent east and south, opencast workings onsite, Southern Washlands Nature Reserve	10	5	2.5	3	375

Table A3 - Hazard Rating: Western Leg - Non-operational Landfill Sites

Site Name	ID	Intersect	Length	Dist (m)	Route surface type	Superficial Aquifer	Bedrock Aquifer	Superficial Geology	Bedrock Geology	Other targets	Waste	Size	I/S type	Length	Score
British Railways Tip	8301	Yes	118	0	Tunnel	Secondary A/Secondary (undifferentiated)	Secondary B	Diamicton	Mudstone (Sidmouth Mudstone Formation)	Valley Brook onsite, Sandback Flashes SSSI 2.5km north	10	2	5	4	400
Hollins Green	7899	Yes	214	0	Viaduct	Secondary A	Secondary B	Sand and Gravel (Glaciofluvial)/clay, silt, sand and gravel (alluvium)	Mudstone, siltstone and sandstone (Tarporley Siltstone Formation)	Manchester Ship Canal immediately southeast, Rixton Clay Pits SSSI, SAC and LNR 1.2km southwest	4	3	3.5	4	168
Lowton Sidings	7676	Yes	323	0	Cut (122m), At Grade (77m), Embankment (124m)	Secondary (undifferentiated)	Principal	Diamicton	Sandstone (Chester Pebble Beds Formation)	Proximity to groundwater source protection Zone 2 and 3, Stream to north and pond onsite, Pennington Flash LNR 960m northeast	10	3	5	4	600

⁵ Landfill is intersected on viaduct – although not directly intersected, pier footings would likely be required within the landfill. Further design development and detailed assessment may reduce the hazard rating.

Table A4 - Hazard Rating: Eastern Leg - Non-operational Landfill Sites

Site Name	ID	Intersect	Length	Dist (m)	Route surface type	Superficial Aquifer	Bedrock Aquifer	Superficial Geology	Bedrock Geology	Other targets	Waste	Size	I/S type	Length	Score
Land West Of Railway	2495	Yes	75	0	Viaduct	Secondary A (in south) / NR	Secondary A	Alluvium in south	Halesowen Formation - mdt, sist, sst (70-127m thick)	Stream in south, Kingsbury oil terminal 50m south, Kingsbury Wood SSSI 240m east	10	3	3.5	3	315
Measham Red Bank Brickworks	742	No	0	25	No intersect	NR	Secondary undifferentiated / Principal	NR	Bromsgrove Sandstone Formation - sst, mds / Tarporley Formation - Sst	Total catchment zone 3, River Mease (SSSI and SAC) 200m west, drainage immediately north, industrial works onsite, clay pit immediately south	4	3	1	1	12
Smoile Wood	4128	No	0	25	No intersect	NR	Secondary A	NR	Pennine Lower CM - Mdt, Sist, Sst	Pond/reservoir onsite, Lount Meadows SSSI 100m southwest and southeast	10	3	1	1	30
Blackwell Tip	3800	Yes	134 (Emb), 140 (Via)	0	Embankment, Viaduct	Secondary A (centre of site) / NR	Secondary A	Alluvium in centre of site	Pennine Middle Coal Measures - Mds, Sist, Sst (200m thick)	Normanton Brook onsite flowing in west direction. Sewage works 350m east upstream	1	3	3.5	4	42
Cragg Lane	8566	Yes	281	0	Cutting	NR	Secondary A	NR	Top Hard Rock - Sst / Pennine Middle CM - Sst, Sist, Mds	Drains within Pipes Farm to northeast, Spring located 240m southwest	4	2	5	4	160
Hall Lane Tip	570	No	0	25	No intersect	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sst, Mds, Sist	Quarry works onsite, quarry immediately west, River Rotherham immediately east, Norbriggs Flash LNR 500m east	10	3	1	1	30
Railway Cutting	3506	Yes	37	0	Embankment	NR	Secondary A	NR	Oaks Rock - Sst / Pennine Middle CM - Mds, Sist, Sst	Stream immediately north, series of lakes/reservoirs to east (north of Nor Wood)	4	1	2.5	3	30
Denaby Lane	5070	Yes	79	0	Viaduct	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sst, Mds, Sist	Within old Denaby Wetlands LNR, River Don 90m north, 250m New Cut Canal, sewage works 100m northeast	10	1	3.5	3	105
Brickworks Quarry	4931	Yes	1 (via), 50 (emb), 10 (AG), 154 (cut)	0	Viaduct, Embankment, At grade and cutting	NR	Secondary A	NR	Pennine Middle CM - Sst, Mds, Sist	New Cut Canal 30m south, River Don 100m south, Local Nature Reserve 500m south SSSI >500M northeast	4	3	5	4	240
Land off Southmoor Road	917	Yes	17	0	Embankment	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)	Stream 140m east and north	10	2	2.5	2	100
Land at Bellholme	4778	Yes	14	0	Embankment	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)	Drain immediately east	1	1	2.5	2	5
Abbotts Tip	5844	Yes	114	0	Cutting, Embankment (different from depot line)	NR	Secondary A	NR	Ackworth Rock sandstone / Pennine Middle CM - Mds, Sist, Sst	Upper lake 600m east, Nostell Brickyard Quarry SSSI 850m southeast	10	2	5	4	400
Armitages Quarry	503	Yes	79 (cut), 89 (tun)	0	Cutting, Tunnel	NR	Secondary A	NR	Pennine Middle CM - Sils, Mds, Sst and Thornhill Rock - Sst (to c. 40m)	Stream	10	2	5	4	400
Lemonroyd	502	Yes	132	0	Viaduct	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sils, Mds, Sst	Drain onsite, stream immediately northeast, Canal 30m northeast and River Aire 330m northeast	4	3	3.5	4	168
Hunslet Grange, Former Housing Site	5848	No	0	25	No intersect	Secondary A	Secondary A	River Terrace deposits	Pennine Lower CM - Mds, Sist, Sst	River Aire 950m northeast	7	3	1	1	21

ANNEX B Preferred Scheme Landfill Sites

Table B1 - Western Leg: Operational Landfill Sites

Site name	ID	Date of issue	Area (Ha)	Type of landfill	Intersect	Length (m)	Dist (m)	Route surface type	Superficial aquifer	Principal aquifer	Superficial geology	Bedrock geology
Minosus Ltd	496	20/08/2004	42.99	A2 : Other Landfill Site taking Special Waste	Yes ⁶	395	0	Viaduct (70m)/ Embankment (325m)	Unproductive	Secondary A/Secondary (undifferentiated)	Diamicton, river terrace deposits (sand and gravel), alluvium (clay, silt, sand and gravel)	Halite stone and mudstone (Northwich Halite Member)
Risley IV Landfill Site	857	28/08/1998	65.36	A1 : Co-Disposal Landfill Site	Yes	173	0	Embankment	Secondary (undifferentiated)	Principal	Diamicton	Sandstone (Wilmslow Sandstone Formation)

Table B2 - Eastern Leg: Operational Landfill Sites

Site name	ID	Date of issue	Area (Ha)	Type of landfill	Intersect	Length (m)	Dist (m)	Route surface type	Superficial aquifer	Bedrock aquifer	Superficial geology	Bedrock geology
Kingsbury - Inert & Non Hazardous Waste Landfill Site	215	31/03/2006	27.60	A4 : Household, Commercial & Industrial Waste Landfill	Yes	191	0	Embankment	NR	Secondary A	NR	Etruria Formation - Mds, Sst and Halesowen Formation - Sst and Pennine Lower CM - Tarporley Siltstone Formation (upto 220m thick), Bromsgrove Sandstone Formation
Red Bank Manufacturing Measham Landfill Site	599	11/08/1977	11.08	A7 : Industrial Waste Landfill (Factory curtilage)	Yes	549	0	Viaduct	Unproductive/Secondary A	Secondary undifferentiated	River Terrace Deposits/ Alluvium	Pennine Lower CM - Mds, Silts, Sst
Staveley Landfill, Hall Lane	374	07/02/1994	16.79	A4 : Household, Commercial & Industrial Waste Landfill	No	0	250	No intersect	NR	Secondary A	NR	Pennine Lower CM - Mds, Silts, Sst
Mexborough Landfill	209	26/02/1993	6.85	A4 : Household, Commercial & Industrial Waste Landfill	Yes	44 (Emb), 10 (AG), 156 (cut)	0	Embankment, At Grade, Cutting	NR	Secondary A	NR	Pennine Lower CM - Mds, Silts, Sst
Welbeck Landfill Site	892	30/05/2013	89.69	Waste landfilling; >10 t/d with capacity >25,000t excluding inert waste	Yes	26	0	Embankment	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Mds, Silts, Sst
Gamblethorpe Landfill	339	08/03/1996	28.63	A4 : Household, Commercial & Industrial Waste Landfill	No	0	250	No intersect	NR	Secondary A	NR	Pennine Lower CM - Mds, Silts, Sst
Copley Lane Quarry	252	07/05/1991	8.42	Waste landfilling; >10 t/d with capacity >25,000t excluding inert waste	No	0	250	No intersect	NR	Principal	NR	Limestone of the Brotherton Formation (0- 20m thick)

⁶ Landfill is intersected on viaduct – although not directly intersected, pier footings etc would likely be required within the landfill. Further design development and detailed assessment may reduce the hazard rating.

Table B3 - Western Leg: Non-Operational Landfill Sites

Site name	ID	First input	Last input	Inert	Comm	Hhold	Ind	Intersect	Area (Ha)	Length	Dist (m)	Route surface type	Superficial aquifer	Principal aquifer	Superficial geology	Bedrock geology
British Railways Tip	8301	Data unavailable	Data unavailable					Yes	4.07	118	0	Tunnel	Secondary A/Secondary (undifferentiated)	Secondary B	Diamicton	Mudstone (Sidmouth Mudstone Formation)
Griffiths Road Limebeds	8382	31/12/1952	01/04/1994	Yes			Yes	No	43.58	0	250	No Intersect	Secondary (undifferentiated)	Secondary B	Diamicton	Mudstone (Sidmouth Mudstone Formation)
Booth Bank Farm	8876	Data unavailable	Data unavailable					No	6.20	0	250	No Intersect	Secondary (undifferentiated)	Principal	N/R	Siltstone, mudstone and sandstone (Tarpoley Siltstone Formation)
Hollins Green	7899	01/11/1989	31/07/1991				Yes	Yes	9.37	214	0	Viaduct	Secondary A	Secondary B	Sand and Gravel (Glaciofluvial) /clay, silt, sand and gravel (alluvium)	Mudstone, siltstone and sandstone (Tarpoley Siltstone Formation)
Palmerston Street Landfill	7682	01/09/1986	31/12/1987	Yes			Yes	No	1.47	0	250	No Intersect	Secondary (undifferentiated)	Principal/Secondary A	Alluvium (clay, silt, sand and gravel), Diamicton	Sandston (Chester Pebble Beds Formation) and mudstone (Manchester Marls Formation)
Lowton Sidings	7676	Data unavailable	Data unavailable					Yes	6.73	323	0	Cutting (122m), At Grade (77m), Embankment (124m)	Secondary (undifferentiated)	Principal	Diamicton	Sandstone (Chester Pebble Beds Formation)
Lily Lane	6830	31/12/1979	07/07/1983	Yes	Yes	Yes	Yes	No	22.89	0	250	No Intersect	Secondary A/Secondary (undifferentiated)	Principal/Secondary A	Alluvium (clay, silt and sand), Diamicton	Mudstone, siltstone and sandstone (Pennine Middle Coal Measures Formation, Nob End Rock, Collyhurst Sandstone Formation)

Table B4 - Eastern Leg: Non-Operational Landfill Sites

Site name	ID	First input	Last input	Inert	Comm	Hhold	Ind	Intersect	Area (Ha)	Length (m)	Dist (m)	Route surface type	Superficial aquifer	Bedrock aquifer	Superficial geology	Bedrock geology
Cocksparrow Farm	9476	12/04/1964	12/01/1988	Yes				No	0.20	0	250	No intersect	Unproductive	Secondary B	Head deposits	Mercia Mudstone Group - mds (1350m+)
M42 Mullensgrove Farm	3343	31/12/1984	31/12/1985	Yes				No	4.29	0	250	No intersect	Secondary undifferentiated	Secondary B	Head, River Terrace deposits	Mercia Mudstone Group - mds (1350m+)
Kingsbury Landfill Site	2459	31/12/1976	01/10/1988	Yes				No	0.39	0	250	No intersect	Secondary A / NR	Secondary B	Alluvium locally	Mercia Mudstone Group - mds (1350m+)
BCA Kingsbury	2458	31/12/1976	31/12/1983	Yes			Yes	No	1.37	0	250	No intersect	Secondary A / NR	Secondary B	Alluvium locally	Mercia Mudstone Group - mds (1350m+)
The Coppice	339	31/12/1989	01/12/1990	Yes				No	2.04	0	250	No intersect	Secondary A / NR	Secondary B	Alluvium locally	Mercia Mudstone Group - mds (1350m+)
Land West Of Railway	2495	Dataunavailable	Data unavailable					Yes	22.61	75	0	Viaduct	Secondary A (in south) / NR	Secondary A	Alluvium in south	Halesowen Formation - mdt, sist, sst (70-127m thick)
Measham Red Bank Brickworks	742	31/12/1930	Date unavailable	Yes			Yes	No	5.98	0	25	No intersect	NR	Secondary undifferentiated	NR	Bromsgrove Sandstone Formation - sst, mds
Smoile Wood	4128	31/12/1981	04/06/1993	Yes	Yes	Yes	Yes	No	7.49	0	25	No intersect	NR	Secondary A	NR	Pennine Middle CM - Mdt, Sist, Sst

Site name	ID	First input	Last input	Inert	Comm	Hhold	Ind	Intersect	Area (Ha)	Length (m)	Dist (m)	Route surface type	Superficial aquifer	Bedrock aquifer	Superficial geology	Bedrock geology
Fields Adjacent and Behind to Lockhouse at Cranfleet Lock	3673	28/02/1994	14/04/1994				Yes	No	0.97	0	250	No intersect	Secondary A	Secondary B	Hemington Member - silts and gravels	Edwalton Member - Mds
S.W. Bailey and Sons	3641	31/12/1974	23/12/1986	Yes			Yes	No	0.06	0	250	No intersect	Secondary A	Principal	Alluvium	Nottingham Castle Sanstone Formation (70-170m thick)
Church Farm	3638	06/12/1991	31/03/1993	Yes				No	1.80	0	250	No intersect	Secondary A	Principal	Alluvium in east	Nottingham Castle Sanstone Formation (70-170m thick)
Old Works Tip	3631	17/02/1978	27/04/1994	Yes				No	13.30	0	250	No intersect	Secondary A	Secondary A	River Terrace deposits in west / Alluvium in east	Wingfield Flags - Sst (60m thick) in southwest / Pennine Lower CM - Sst, Mds, Sist (650-720m thick)
Eel Hole Farm	3858	31/12/1976	31/03/1994	Yes				No	0.54	0	250	No intersect	NR	Principal	NR	Cadeby Formation - Dolostone (upto 100m thick)
Hucknall Airfield	3857	31/12/1957	31/12/1993	Yes				No	1.94	0	250	No intersect	NR	Principal	NR	Cadeby Formation - Dolostone (upto 100m thick)
Blackwell Tip	3800	31/12/1959	30/11/1986	Yes				Yes	12.20	134 (Emb), 140 (Via)	0	Embankment, Viaduct	Secondary A (centre of site) / NR	Secondary A	Alluvium in centre of site	Pennine Middle Coal Measures - Mds, Sist, Sst (200m thick)
Cragg Lane	5866	Date unavailable	31/12/1978		Yes	Yes	Yes	Yes	1.01	281	0	Cutting	NR	Secondary A	NR	Top Hard Rock - Sst / Pennine Middle CM - Sst, Sist, Mds
Pit Lane	5240	31/12/1985	31/12/1985	Yes				No	0.49	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Lower Coal Measures - Sist, Sst, Mds
Tip No 11-054	5224	31/12/1968	30/11/1986					No	66.49	0	250	No intersect	NR / Secondary A (in southwest)	Secondary A	Alluvium in southwest	Pennine Middle CM - Sst, Mds, Sist (between 200-650m)
Hall Lane Tip	570	Date unavailable	31/12/1966					No	18.50	0	25	No intersect	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sst, Mds, Sist
Chesterfield Road	5215	31/12/1983	31/12/1990	Yes	Yes	Yes	Yes	No	5.08	0	250	No intersect	NR	Secondary A	NR	Pennine Middle CM - Sst, Mds, Sist (between 200-650m)
Railway Cutting	3506	31/12/1969	31/12/1976	Yes			Yes	Yes	0.84	37	0	Embankment	NR	Secondary A	NR	Oaks Rock - Sst / Pennine Middle CM - Mds, Sist, Sst
Bantry Road	3468	31/12/1949	Data unavailable	Yes	Yes	Yes	Yes	No	5.40	0	250	No intersect	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick) / Wickersley Rock - Sst
Hellaby Landfill	826	31/12/1973	31/12/1979		Yes	Yes	Yes	No	6.89	0	250	No intersect	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)
Denaby Lane	5070	Date unavailable	Date unavailable					Yes	0.60	79	0	Viaduct	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sst, Mds, Sist
Mexborough PS	611	31/12/1945	Data unavailable				Yes	No	9.92	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sst, Mds, Sist
NCB Land south of Pastures Road	232	Date unavailable	31/03/1971		Yes			No	3.15	0	250	No intersect	Secondary A	Secondary A	Alluvium (east) / None (west)	Ackworth Rock - Sst (east) / Pennine Middle CM - Sist, Mds, Sst (west)

Site name	ID	First input	Last input	Inert	Comm	Hhold	Ind	Intersect	Area (Ha)	Length (m)	Dist (m)	Route surface type	Superficial aquifer	Bedrock aquifer	Superficial geology	Bedrock geology
Off Pasture Road / Part of OS field 5663	4932	22/06/1978	03/12/1980	Yes	Yes	Yes	Yes	No	14.17	0	250	No intersect	Secondary A / NR	Secondary A	Alluvium locally	Ackworth Rock - Sst (east) / Pennine Middle CM - Sist, Mds, Sst (west)
Brickworks Quarry	4931	11/11/1977	18/05/1981	Yes			Yes	Yes	6.60	1 (via), 50 (emb), 10 (AG), 154 (cut)	0	Viaduct, Embankment, At grade and cutting	NR	Secondary A	NR	Pennine Middle CM - Sst, Mds, Sist
Hickleton	4922	10/11/1980	21/08/1984	Yes	Yes			No	2.35	0	250	No intersect	NR	Principal	NR	Cadeby Formation - Dolostone
Manface HWS Quarry, Landfill Site	5607	31/12/1985	31/12/1985	Yes	Yes	Yes		No	2.91	0	250	No intersect	NR	Secondary A	NR	Ravenfield Rock - Sst
Manface Quarry, Landfill Site	5886	31/12/1985	31/12/1989					No	0.24	0	250	No intersect	NR	Secondary A	NR	Ravenfield Rock - Sst
Land off Southmoor Road	917	Date unavailable	Date unavailable					Yes	2.54	17	0	Embankment	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)
South Moor Whin	8898	Date unavailable	31/12/1950			Yes		No	1.77	0	250	No intersect	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)
Land at Bellholme	4778	Date unavailable	Date unavailable	Yes				Yes	0.31	14	0	Embankment	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)
Brierley Railway Cutting	8896	Date unavailable	Date unavailable			Yes		No	0.14	0	250	No intersect	NR	Secondary A	NR	Pennine Upper CM - Mds, Sist, Sst (upto 350m thick)
Abbotts Tip	5844	Date unavailable	Date unavailable					Yes	2.44	114	0	Cutting, Embankment (different from depot line)	N/K	Secondary A	N/K	Ackworth Rock sandstone / Pennine Middle CM - Mds, Sist, Sst
Land Adjacent to Crossley Street	5846	30/11/1988	31/05/1991	Yes	Yes			No	1.24	0	250	No intersect	NR	Secondary A	NR	Pennine Middle CM - Sist, Mds, Sst
Foxholes	5887	01/02/1962	31/08/1977	Yes	Yes	Yes		No	12.48	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sist, Mds, Sst
Fleet Bridge Street Works	5853	Date unavailable	31/12/1976	Yes	Yes	Yes		No	13.22	0	250	No intersect	Secondary A	Secondary A	Alluvium / River Terrace deposits	Pennine Middle CM - Sist, Mds, Sst
Armitages Quarry	503	30/04/1947	Date unavailable					Yes	4.62	79 (cut), 89 (tun)	0	Cutting, Tunnel	NR	Secondary A	NR	Pennine Middle CM - Sils, Mds, Sst and Thornhill Rock - Sst (to c. 40m)
Lemonroyd	502	04/09/1973	Date unavailable		Yes			Yes	8.35	132	0	Viaduct	Secondary A	Secondary A	Alluvium	Pennine Middle CM - Sils, Mds, Sst
Skelton Grange Power Station	632	31/12/1945	Date unavailable	Yes			Yes	No	5.67	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Lower CM - Mds, Sist, Sst
Haigh Park Road	5726	01/02/1982	Date unavailable				Yes	No	0.16	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Lower CM - Mds, Sist, Sst
IMI Yorkshire Alloys Limited	5727	01/02/1982	Date unavailable			Yes		No	0.45	0	250	No intersect	Secondary A	Secondary A	Alluvium	Pennine Lower CM - Mds, Sist, Sst
Land at Junction of Pepper Road/Pepper Lane	5722	31/10/1983	30/04/1984	Yes	Yes			No	0.5	0	250	No intersect	Secondary A	Secondary A	River Terrace deposits	Pennine Lower CM - Mds, Sist, Sst
Hunslet Grange, Former Housing Site	5848	Date unavailable	Date unavailable	Yes	Yes			No	12.67	0	25	No intersect	Secondary A	Secondary A	River Terrace deposits	Pennine Lower CM - Mds, Sist, Sst



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